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E7.3 100.3.0  
CR-129970

Bimonthly Report: 11/4/72 - 1/4/73

ERTS Proposal No. 108

Remote Sensing of Ocean Currents

George A. Maul, Principal Investigator, GSFC ID-CO315

#### OBJECT

The object of this investigation is to locate ocean current boundaries by sensing the color change associated with the cyclonic edge of the zone of maximum horizontal velocity shear. The test site is the eastern Gulf of Mexico where the strongly baroclinic flow from the Yucatan Straits forms into the Loop Current. The research will attempt to use ERTS data in the investigation of ocean color sensing from simultaneous observations by ship and satellite.

#### FIELD DATA COLLECTION

A time-series of the Loop Current is being obtained by occupying the suborbital track of ERTS that passes into the Yucatan Straits every 36 days. The research vessel is on the suborbital track on the day of satellite transit collecting continuous chlorophyll-a, volume scattering, and radiometric temperature (in conjunction with the NOAA-2 IR sensors); hourly (15 km interval) expendable bathythermograph, surface bucket temperature and salinity samples are being obtained. During daylight, spectra of upwelling and downwelling radiance (400-800 nm) are being measured with a  $\frac{1}{4}$  meter Ebert scanning spectroradiometer. Upon reaching the Yucatan Straits a temperature/salinity/depth (STD) transect of nine stations is being made in order to determine the geostrophic current and transport fields. After the STD transect, the surface boundary of the Loop Current is being tracked using the same measurements outlined for the subsatellite track. A second STD transect of the Florida Straits from Key West to Havana is made in order to determine the discharge from the basin.

#### WORK SUMMARY

One cruise was undertaken during this reporting period. This cruise was a routine continuation of the 36 day series begun last August. The attached cruise report details the cruise.

(E73-10030) REMOTE SENSING OF OCEAN  
CURRENTS Bimonthly Report, 4 Nov. 1972

N73-15363

- 4 Jan. 1973 (National Oceanic and  
Atmospheric Administration) 6 p HC \$3.00

Unclas

CSCL 08C G3/13 00030

Due to a mistake by the NDPF, a nine track tape of a scene was sent instead of the usual 7 track. By the time we figured out the format, a program was written to read the 9 track data; we can now read either format on NOAA's CDC 6600. A plot of several scan lines appeared to have high (spatial) frequency variations in the data. The data from several scenes was reformatted into time series and analyzed on the FESTSA subroutines. Both the periodogram and the Tukey Spectrum showed no significant peaks of energy at any one frequency. So for the few scenes we investigated, the ERTS MSS digital data appears to be essentially noise free.

Data processing from the cruises, cruise planning and execution, chemical analysis and year and holiday vacations consumed most of the rest of the reporting period. All STD and spectroradiometric records to date have been digitized. The Ebert spectroradiometer was recalibrated at NASA's GSFC Office of Earth Observations. Several chips with oceanographic information for which we have surface information were enhanced on NOAA's Multispectral Data Corp four channel viewer.

#### WORK PLANS

Field work will continue for the next reporting period in order to be on the suborbital track on 11 January and 16 February, weather permitting. Routine processing of the cruise data will continue as before.

As noted in the semi-annual report, the ERTS sensor seems to be a better sea-state indicator than ocean color sensor. To study the effect of sea-state on the spectra, a flight aboard one of NOAA's RFF aircraft will be made. The object is to fly down wind over a homogeneous water body under fetch limited conditions. Concurrent aerial photographs will record the changes in sea-state (i.e. white caps and foam coverage). These data will be used to quantitatively determine this variable in the ERTS bands as well as across the whole spectrum. The exact date of the flight will depend on other experiments since this one is a space available flight.

Computer processing will be directed towards image enhancement by grey-scale stretching. The present NDPF film products are not optimized for the ocean scene and from personal inquiries it appears that special requests of this nature cannot be handled because of the heavy work load.

## DISCUSSION

Several important features of the Gulf of Mexico's circulation have been seen in the ERTS data. An example of exchange of water from Florida Bay and the Gulf Stream has been observed which confirms certain historical drift bottle studies. Vortex streets in the lee of Cozumel Island have been observed and the boundary of the Loop Current has been located and confirmed by surface information. Multiband enhancement of these chips has been disappointing; density slicing of a single optimized chip appears to be most promising and will be attempted on NOAA facilities.

An article, "Use of ERTS-1 for Oceanic Observation of New York Bight", by Robert Charnell and George A. Maul, has been accepted for publication in Nature. A full report has been made on this work as a NOAA technical report under a similar title.

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14 January 1973

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PHYSICAL OCEANOGRAPHY LABORATORY  
NASA/GSFC  
STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY  
CRUISE REPORT

B-7215 R/V BELLOWS (SUS-7221)

5 - 11 December 1972

I. OBJECTIVES

The purpose of this cruise was to continue a time-series of the location of the Loop Current as part of AOML's project with the Earth Resources Technology Satellite (ERTS) and the NOAA-2 Meteorological Satellite. The research vessel steamed along the suborbital track of ERTS that leads into the Yucatan Channel on the day of satellite transit. The research is intended to obtain baseline information on the spectroradiometric properties of the ocean's surface useful for remote sensing and the detection of that information at orbital altitudes.

II. PROPOSED SCHEDULE

<u>Date</u>	<u>Time</u>	<u>Activity</u>
December	EST	
4	2200	Depart St. Petersburg
6	1000	Satellite Transit
7	1100	Commence STD section of Yucatan Straits
8	0400	Commence tracking current
9	2200	Arrive Dry Tortugas
10	1600	Arrive Key West; fuel
10	2000	Depart Key West; commence STD section of Florida Straits
11	1800	Arrive Key West; offload AOML personnel and equipment.

### III. STATION POSITIONS

The suborbital track occupied had the following beginning and ending coordinates:

27°44'N	84°30'W
22°32'N	85°34'W

The station locations for the Yucatan Straits STD transect are:

1.	21°50'N	85°11'W
2.	21°48'N	85°21'W
3.	21°46'N	85°32'W
4.	21°44'N	85°42'W
5.	21°42'N	85°53'W
6.	21°40'N	86°03'W
7.	21°38'N	86°13'W
8.	21°36'N	86°24'W
9.	21°34'N	86°34'W

The easternmost station is 12 n. mi. west of Cabo San Antonio; the westernmost station is 12 n. mi. east of Isla Contoy.

The cruise from Isla Contoy to Dry Tortugas was a saw-toothed path, which crossed the surface boundary layer zone of the current. The northern limit STD transect of the Florida Straits was at the 100 fathom curve south of Sand Key light and terminated 12 n. mi. north of Cuba. The station locations are:

10.	24°21'N	81°54'W
11.	24°11'N	81°56'W
12.	24°01'N	81°58'W
13.	23°51'N	82°01'W
14.	23°36'N	82°04'W
15.	23°21'N	82°08'W

### IV. PERSONNEL

G. Maul, Chief Scientist	NOAA/AOML
J. Festa	NOAA/AOML
M. Ednoff	FSU
G. Dingle	NOAA/AOML

### V. DESCRIPTION OF OPERATIONS

Data collection commenced at the northern end of the

suborbital track. Continuous flow measurements of chlorophyll-a and continuous radiometric sea surface temperature were recorded on a dual channel recorder. While on the track, hourly XBT's, surface bucket temperature, surface salinity, and measurements of scattering ratios were taken. Spectra of upwelling and downwelling visible radiation were not observed due to rough seas. Loran A fixes were made at one hour intervals and at major course, and/or speed changes. One liter samples were filtered for a spectrophotometer calibration of chlorophyll-a every six hours and at major changes in the fluorescence.

STD stations were taken to 1000 meters or 100 meters from the bottom whichever is least. Surface calibration points were taken at each cast. Lowering speed about 30 meters per minute; raising speed was the winch maximum. Loran positions were taken at the beginning and ending of each casts.

Easterly winds in excess of 20 knots blew during the entire survey. In the current the seas were 3-5 meters. The ship, the scientific equipment and all hands took a severe beating due to the weather. The chief scientist did double duty as a watch officer. Clearly, winter operations are beyond the capability of the BELLOWS, and it is not recommended to use her under these conditions. The crew and the scientific party deserve a strong commendation for their efforts and perserverence during this cruise.

## VI. LOGS

Chief Scientist Log  
Deck Log  
Track Chart  
Loran Log (C&GS 722)  
Hydrographic Station Log  
Bathymograph Log

Submitted by: George A. Maul  
January 11, 1973